INDEXIBLE TURNING TOOL FOR CHIPFORMING MACHINING

0001] This application claims priority under 35 U.S.C. §§119 and/or 365 to Patent Application Serial No. 0203199-5 filed in Sweden on October 31, 2002, the entire content of which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

0002] The present invention relates to a turning tool for chip forming machining, wherein the tool includes a holder, which is equipped with insert pockets for occupying interchangeable inserts, as well as a securing portion, which is intended to be received in a tool machine. The turning tool according to the present invention is preferably intended for metal machining.

0003] In a brochure from Mapal published in September 2002 there is previously known a milling tool for chip forming machining, wherein said milling tool has inserts oriented laterally from a longitudinal axial direction for the tool, i.e., they are situated on the front surface of said milling tool. It shall be emphasized in this connection that it is a rotary tool, and therefor the forces which affect the inserts are not comparable to the forces which affect an insert on a turning tool.

0004] A primary purpose of the present invention is to provide a turning tool of the above-captioned type, which promotes the tool's availability for different machining operations.

0005] Another purpose of the present invention is to reduce the setting time between different types of working operations, for example turning and threading

SUMMARY OF INVENTION

0006] At least the primary purpose of the present invention is achieved by an indexible turning tool which comprises a tool body that includes a securing portion and a holder. The holder is provided with pockets which receive respective replaceable cutting inserts. The pockets are arranged wherein indexing of the tool body about a longitudinal center axis of the holder brings one of the inserts into an operative cutting position. One of the inserts has a main plane oriented laterally relative to the holder's center axis.

DESCRIPTION OF THE DRAWINGS

0007] A number of embodiments of the tool according to the present invention are described below, wherein reference is made to the drawings.

0008] Fig. 1 shows, in a perspective view, an embodiment of an indexible turning tool according to the present invention.

0009] Fig. 2 shows a detail of the cutting head of the tool according to Fig. 1; wherein the cutting head is provided with three exchangeable (replaceably) inserts.

0010] Fig. 3 shows a detail.

0011] Fig. 4 shows a detail of an alternatively cutting head.

0012] Fig. 5 shows, in a perspective view, an alternative embodiment of a tool according to the present invention, wherein the tool is in engagement with a workpiece and the forces acting on the tool.

0013] Fig. 6 shows in detail the cutting head of the tool according to Fig. 5.

0014] Fig. 7 shows how the tool according to Fig. 5 is used in threading.

0015] Fig. 8 shows in a perspective view an alternative tool according to the present invention, where two replaceable inserts are oriented according to principles of the present invention.

0016] Fig. 9 shows, in a perspective view, the tool according to Fig. 8 during machining of a rotary work piece.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

0017] The present invention relates to a turning tool, wherein a "turning tool" of the present invention shall understood to be a non-rotary tool which for example can perform cutoff operations, grooving, turn milling, etc. The turning tool is indexible about a longitudinal center axis to enable one of a plurality of exchangeable cutting inserts to be placed in an operative cutting position. Additionally, each of the inserts is itself indexible.

0018] The tool according to the present invention as shown in Fig. 1 comprises a tool body that includes a holder 1 and a securing portion 9. The holder 1 is provided at its free end with a number of insert pockets for receiving replaceable, indexible inserts 3, *5,* 7, the number of which in the shown embodiment being three.

0019] All inserts 3-7 are oriented such that their respective main planes P extend laterally in relation to the longitudinal center axis CL of the holder. The "main plane" shall be understood as a plane which coincides with the bottom surface of the insert.

0020] As is shown in Fig. 1 the holder 1 is non-centrally (i.e., eccentrically) located on the securing portion 9 of the tool body, which is intended to be tightened firmly in a tool machine. The reason why the eccentric placement of the holder 1 is possible is that the tool according to the present invention is a turning tool and thus does not rotate during operation. However, it is possible to index the tool, i.e. rotate the securing portion 9 about an indexing axis in order to feed a new insert to an operative cutting location. That is, the indexing of the tool can take place by rotating the holder 1 about its longitudinal center axis CL which would thus define an indexing axis. Alternatively, or additionally, indexing could take place by rotating the securing portion 9 about its longitudinal center axis CL' which would thus define an indexing axis.

0021] In Fig. 2 the inserts 3, *5,* 7 are shown more in detail, wherein the insert 3 has been inclined such that its main plane P forms an acute angle α with a perpendicular reference plane oriented perpendicularly to the holder's center axis CL, and wherein the angle α lies in a tangential reference plane i.e., a plane oriented generally tangentially relative to a radius of the holder. Such an inclination could be achieved, for example, by rotating the insert 3 of Fig. 1 about an axis A defined by a radius of the holder 1 that passes through the insert's center axis E (see Fig. 2 for the axis E). From Fig. 2 it will be appreciated that a line L1 extending parallel to the main plane P from an axially forwardmost corner C1 of the insert's front cutting face and through the insert's center axis E forms the angle α with a reference line R1 that lies in the perpendicular reference plane and also passes through both the insert's center axis E and the axially forwardmost corner of the insert's front cutting face. The angle α has suitably a value in the range $-45 \leq \alpha \leq +45$ wherein the angle is measured from the reference line RI, and where the angle α is positive above the reference line R1 and negative under the reference line R1.

0022] In Fig. 3 is shown how corresponding insert 103 on an alternative holder 101 has been inclined at an angle β such that the main plane P forms an acute angle β with a perpendicular reference plane, i.e., a plane oriented perpendicularly to the holder's center axis CL, wherein the angle β lies in an axial reference plane i.e., a plane that contains the holder's center axis CL. The angle β could be formed, for example, by rotating the insert 3 of Fig.1 about an axis F which is: (i) oriented tangent to a radius of the holder 1 and (ii) extends through the insert's center axis E. It will be appreciated that a line L2 extending parallel to the main plane of the insert 103 from an axially rearmost corner of a front cutting face of the insert and through the insert's center axis E forms the angle β with a reference line R2 which lies in the perpendicular reference plane and which also passes through both the insert's center axis E and the axially rearwardmost corner of the insert's front

cutting face. The axially rearwardmost corner of the insert's front cutting face lies adjacent the holder's center axis CL. The angle β has suitably a value in the range —45° ≤ β ≤ +45°, wherein the angle is measured from the reference line R2, and where the angle β is positive above the reference line R2 and negative under the reference line R2.

0023] It will also be appreciated that within the scope of the invention, an insert could be inclined by both of the angles α and β.

0024] A important feature of the present invention is that the main plane of each of the inserts 3; 103, *5,* 7 has a dimension extending laterally in relation to the axial direction CL of the holder 1; 101, wherein according to the present invention also the inserts 3; 103 are regarded as extending laterally across the axial direction CL despite the fact that they are inclined at a certain angle. Generally, this expression "laterally" is given such an interpretation that not only is the insert located in a plane perpendicularly towards the axial direction CL is included but also the insert is inclined within the indicated angular range.

0025] With the embodiment shown in Fig. 4, insert 203 on an alternative holder 201 has been displaced a certain distance d in the axial direction CL relative to the remaining inserts 5 and 7. This promotes the tool's availability to the work piece when chip forming machining is conducted. As shown in Fig. 4 each of the inserts 203, 5, 7 is oriented substantially perpendicular to the axis CL. However, one can within the limits of the invention make arrangement such that or some of the inserts 203, 5, 7 are inclined in the manner shown in Fig. 2 and/or 3.

0026] In Fig. 5 shows how an embodiment of a tool according to the present invention is used. The holder 301 is now centrally (coaxially) oriented in relation to the securing portion 309. Fig. 5 shows schematically how one of three inserts 303, 305, 307, more exactly a copying insert 305, machines a work piece A3.

0027] Even more detail is shown in Fig. 6 of the inserts of the tool according to Fig. 5, wherein these inserts represent a typical set up of inserts. From Fig. 6 it appears how the holder 301 is equipped with a turning insert 303 for heavy duty machining, a copying insert 305 and a threading insert 307. These inserts 303, 305, 307 may been inclined at a certain angle α and/or β as above described.

0028] Shown in Fig. 5 is how different forces affect the copying insert 305, wherein FT designates a tangential force; FA designates an axial force; and FR designates a radial force. The absolute biggest force that influences the insert is the tangential force FT, which in the embodiment according to Fig. 5 has a direction along the longitudinal direction of the holder 301. This means that the tangential force FT is absorbed by the holder 301 without causing a pronounced deflection of the holder 301. The force situation as shown in Fig. 5 entails also less tendency to vibrations than in conventional turning tools.

0029] In Fig. 7 is shown how the tool according to the present invention is used in order to make use of the threading insert 307 to produce a thread on the rotary work piece A3.

0030] In Fig. 8 is shown an alternative embodiment of a tool according to the present invention. As is shown in Fig. 8 two replaceable indexible inserts 403 and 405 are oriented in relation to the holder 401 according to the principles of the present invention, i.e., the main plane of the inserts 403 and 405 extends laterally of the axial direction CL for the tool. A third insert 407 of the tool according to Fig. 8 has a conventional orientation on the holder 401. In the embodiment shown in Fig. 8 the insert 403 is a turning insert while the insert 405 constitutes a copying insert. The inserts 403 and 405 generally perform different types of machining, i.e. the insert 403 performs heavy duty machining while the copying insert 405 performs a finish machining.

0031] Fig. 9 shows examples of how the tool according to Fig. 8 is used when machining a rotary work piece A4. As is shown in Fig. 9 the conventional orientation of the insert 407 causes this insert for example to become useful for internal turning.

0032] The turning tool according to the present invention thus carries a number of exchangeable inserts, preferably of different types, which entails that this turning tool by indexing thereof can be adjusted simply and quickly between different kinds of turning operations.

Conceivable Modifications of the Invention:

0033] In the above described embodiments, the tool according to the present invention is equipped with inserts of three different types, which makes the tool useful in three different kinds of machining operations. However, one can within the limits of the invention also provide tools equipped with interchangeable inserts of only one or two types that are present in different quantities.

0034] Generally, in all of the described embodiments of the tool according to the present invention as described the inserts are secured into their insert pockets by central screws. As this is outstanding conventional technique these screws have not been described in further detail. Within the limits of the present invention the interchangeable inserts might be secured in their insert pockets by alternative clamping means, wherein, in a not limiting sence, one example could include the use of a top clamp portion.